

What is Claimed:

1        1. An introducer for delivering, into the  
2        vasculature at an angiographical bifurcation where a blood  
3        vessel branches into two branched vessels, a bifurcated  
4        endoluminal stent or prosthesis having a proximal portion  
5        adapted to be disposed in said blood vessel and a distal  
6        portion adapted to be disposed at least partially in one  
7        of said two branched vessels, said introducer comprising:

8                (a) a tubular outer sheath;

9                (b) a proximal portion pusher disposed at  
10        least partially within said outer sheath; and

11                (c) a distal portion pusher disposed at least  
12        partially within said proximal portion pusher.

1        2. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 1  
3        further comprising a balloon catheter, having a balloon  
4        attached thereto, disposed at least partially within said  
5        distal portion pusher.

1        3. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 2  
3        further comprising a hemostasis valve attached to the  
4        distal end of said distal portion pusher.

1        4. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 2

3        further comprising wings on said outer sheath and said  
4        proximal portion pusher.

1            5. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 2,  
3        wherein said balloon catheter has an injection orifice  
4        and an injection conduit therein.

1            6. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 2,  
3        wherein said balloon catheter has an inflation orifice  
4        and an inflation conduit therein.

1            7. An introducer for delivering a bifurcated  
2        endoluminal stent or prosthesis as claimed in claim 2,  
3        wherein said balloon catheter has a proximal end with a  
4        nose cone attached thereto.

1            8. An introducer for delivering into the  
2        vasculature at an anatomical bifurcation where a blood  
3        vessel branches into two branched vessels, an endoluminal  
4        prosthesis having a proximal stent portion and a distal  
5        stent portion, said introducer comprising:

6            (a) a tubular outer sheath;

7            (b) a proximal portion pusher disposed at  
8        least partially within said outer sheath and having a  
9        proximal end adapted to contact said proximal stent  
10      portion;

11                     (c) a distal portion pusher disposed at least  
12 partially within said proximal portion pusher and having  
13 a proximal end adapted to contact said distal stent  
14 portion; and

15                     (d) a balloon catheter, having a balloon  
16 attached thereto, disposed at least partially within said  
17 distal portion pusher.

1                     9. An introducer for delivering an  
2 endoluminal stent into the vasculature at an angiographical  
3 bifurcation where a blood vessel branches into two  
4 branched vessels, said introducer comprising:

5                     (a) a tubular outer sheath;

6                     (b) a proximal portion pusher disposed at  
7 least partially within said outer sheath and having a  
8 proximal end adapted to contact a distal end of said  
9 stent; and

10                     (c) a distal portion pusher disposed at least  
11 partially within said proximal portion pusher and secured  
12 to said proximal portion pusher such that proximal ends  
13 of said distal portion pusher and said proximal portion  
14 pusher are flush with one another.

1                     10. A method for delivering a bifurcated  
2 endoluminal stent or prosthesis having a proximal portion  
3 and a first distal portion into the vasculature at an

4       angeological bifurcation where a blood vessel branches  
5       into a first branched vessel and a second branched  
6       vessel, said method comprising the steps of:

7                 (a) inserting a first introducer containing  
8       said stent or prosthesis into the vasculature to a  
9       predetermined delivery location, said first introducer  
10      comprising an outer sheath, a proximal portion pusher,  
11      and a distal portion pusher;

12                 (b) withdrawing said outer sheath of said  
13      first introducer while maintaining said proximal portion  
14      pusher in a fixed position until said proximal portion of  
15      said stent or prosthesis is deployed from said first  
16      introducer into said blood vessel;

17                 (c) withdrawing said outer sheath and said  
18      proximal portion pusher while maintaining said distal  
19      portion pusher in a fixed position until said first  
20      distal portion of said stent or prosthesis is deployed  
21      from said first introducer at least partially into said  
22      first branched vessel; and

23                 (d) withdrawing said first introducer from the  
24      vasculature.

1                 11. A method for delivering a bifurcated  
2       endoluminal stent or prosthesis as claimed in claim 10  
3       further comprising the steps of:

4                     (a) inserting into the vasculature a second  
5 introducer containing a second distal portion of said  
6 stent or prosthesis and comprising an outer sheath and a  
7 pusher;

8                     (b) withdrawing said outer sheath of said  
9 second introducer while maintaining said pusher of said  
10 second introducer in a fixed position until said second  
11 distal portion of said stent or prosthesis is deployed  
12 from said second introducer such that a proximal end of  
13 said second distal portion securely connects to said  
14 proximal portion of said stent or prosthesis, and such  
15 that a distal end of said second distal portion extends  
16 at least partially into said second branched vessel; and

17                     (c) withdrawing said second introducer from  
18 the vasculature.

1                     12. A method for delivering a bifurcated  
2 endoluminal stent or prosthesis as claimed in claim 10  
3 wherein said first introducer further comprises a balloon  
4 catheter having a balloon attached thereto and said  
5 method further comprises the step of inflating said  
6 balloon to at least partially block blood flow in said  
7 blood vessel after inserting said first introducer into  
8 the vasculature.

1                     13. A method for delivering, into the  
2 vasculature at an anegeological bifurcation where a blood  
3 vessel branches into two branched vessels, an endoluminal

4 prosthesis having a proximal stent portion, and a distal  
5 stent portion, said method comprising the steps of:

6 (a) inserting an introducer containing said  
7 prosthesis into the vasculature to a predetermined  
8 delivery location, said introducer comprising an outer  
9 sheath, a proximal stent portion pusher, a distal stent  
10 portion pusher, and a balloon catheter having a balloon  
11 attached thereto;

12 (b) inflating said balloon to at least  
13 partially block blood flow in said blood vessel;

14 (c) withdrawing said outer sheath of said  
15 introducer while maintaining said proximal stent portion  
16 pusher in a fixed position until said proximal stent  
17 portion of said prosthesis is deployed from said  
18 introducer into said blood vessel;

19 (d) withdrawing said outer sheath and said  
20 proximal stent portion pusher while maintaining said  
21 distal stent portion pusher in a fixed position until  
22 said distal stent portion of said prosthesis is deployed  
23 from said introducer into said blood vessel; and

24 (e) withdrawing said introducer from the  
25 vasculature.

1 14. A method of treating an angiographical  
2 disease at a bifurcation site where a blood vessel

3 branches into a first branched vessel and a second  
4 branched vessel comprising the steps of:

5 (a) disposing in said blood vessel a proximal  
6 portion of an endoluminal stent;

7 (b) directing blood flow from said blood  
8 vessel into said first branched vessel through a first  
9 distal portion of said endoluminal stent, said first  
10 distal portion being connected to said proximal portion  
11 and extending into said first branched vessel; and

12 (c) directing blood flow from said blood  
13 vessel into said second branched vessel through a second  
14 distal portion of said endoluminal stent, said second  
15 distal portion being connected to said proximal portion  
16 and extending into said second branched vessel.

1 15. A method of treating an angiographical  
2 disease at a bifurcation site where a blood vessel  
3 branches into a first branched vessel and a second  
4 branched vessel as claimed in claim 14 wherein said  
5 disease is stenosis.

1 16. A method of treating an angiographical  
2 disease at a bifurcation site where a blood vessel  
3 branches into a first branched vessel and a second  
4 branched vessel as claimed in claim 14 that further  
5 comprises covering any of said proximal portion, said  
6 first distal portion, and said second distal portion with  
7 fabric.

1               17. A method of treating an angeological  
2 disease at a bifurcation site where a blood vessel  
3 branches into a first branched vessel and a second  
4 branched vessel as claimed in claim 16 wherein said  
5 disease is an aneurysm.

1               18. A method of treating an angeological  
2 disease at a bifurcation site where a blood vessel  
3 branches into a first branched vessel and a second  
4 branched vessel as claimed in claim 16 wherein said  
5 disease is an occlusion.

1               19. An endoluminal stent comprising a  
2 plurality of hoops which are axially displaced in a  
3 tubular configuration along a common axis, each of said  
4 hoops

5               (a) being formed by a substantially complete  
6 turn of a sinuous wire having apices, and

7               (b) having a circumference that lies in a plane  
8 substantially perpendicular to the longitudinal axis of  
9 said stent;

10              wherein apices of adjacent hoops are juxtaposed  
11 to one another, and at least two juxtaposed apices are  
12 connected by a securing means.

1               20. A stent as recited in claim 19 in  
2 combination with one or more additional stent segments.

1           21. A stent as recited in claim 20 wherein at  
2 least one of said additional stent segments comprises a  
3 plurality of hoops which are axially displaced in a  
4 tubular configuration along a common axis, each of said  
5 hoops

6                 (a) being formed by a substantially complete  
7 turn of a sinuous wire having apices, and

8                 (b) having a circumference that lies in a plane  
9 substantially perpendicular to the longitudinal axis of  
10 said stent;

11                 wherein apices of adjacent hoops are juxtaposed  
12 to one another, and at least two juxtaposed apices are  
13 connected by a securing means.

1           22. A stent as recited in claim 20 wherein  
2 said one or more additional segments are axially aligned  
3 with one another.

1           23. A stent as recited in claim 20 wherein  
2 said one or more additional segments are secured to one  
3 another by connecting means connecting at least some of  
4 the apices of hoops at mating ends of said stent and said  
5 additional segments.

1           24. A stent as recited in claim 20 wherein  
2 adjacent hoops are of the same diameter.

1           25. A stent as recited in claim 20 wherein  
2 adjacent hoops are of a different diameter.

1           26. A stent as recited in claim 22 wherein  
2 said axially aligned segments are connected to one  
3 another by a tubular fabric element.

1           27. A stent as recited in claim 20 wherein a  
2 first additional segment is axially parallel to, but non-  
3 common co-axial with, said stent.

1           28. A stent as recited in claim 27 further  
2 comprising a second additional segment axially parallel  
3 to said stent, but non-co-axial with either said stent or  
4 said first additional stent segment.

1           29. A stent as recited in claim 28 wherein at  
2 least one of said additional stent segments is of  
3 frustoconical shape and is further combined with an  
4 additional stent segment, one end of which includes a  
5 mating frustoconical shape.

1           30. A stent as recited in claim 29, wherein  
2 said mating frustoconical stent segments are adapted to  
3 be separately placed in a bifurcated artery and then, by

4 expansion of one of said frustoconical stent segments,  
5 secured to one another

1           31. An endoluminal stent as claimed in claim  
2 19 wherein said hoops are formed of a single continuous  
3 wire.

1           32. An endoluminal stent as claimed in claim  
2 19 wherein said securing means is a suture.

1           33. An endoluminal stent as claimed in claim  
2 32 wherein said suture is a tied loop of thermoplastic  
3 material.

1           34. An endoluminal stent as claimed in claim  
2 19 wherein said securing means is a ring.

1           35. An endoluminal stent as claimed in claim  
2 19 wherein said securing means is a staple.

1           36. An endoluminal stent as claimed in claim  
2 19 wherein said securing means is wire twisted into loop.

1           37. An endoluminal stent as claimed in claim  
2 36 wherein said wire is nitinol.

1               38. An endoluminal stent as claimed in claim  
2       19 wherein said securing means is bead of thermoplastic  
3       material.

1               39. An endoluminal stent as claimed in claim  
2       19 wherein the plane of the circumference at each  
3       longitudinal end of the stent is square to the  
4       longitudinal axis of the stent.

1               40. An endoluminal stent as claimed in claim  
2       19 wherein said stent is at least partially covered in  
3       fabric.

1               41. An endoluminal stent as claimed in claim  
2       31 wherein said wire is nitinol.

1               42. A method of making an endoluminal stent  
2       having a plurality of hoops which are axially displaced  
3       in a tubular configuration, each of said hoops being  
4       formed by a substantially complete turn of a sinuous wire  
5       with apices and having a circumference that lies in a  
6       plane substantially perpendicular to the longitudinal  
7       axis of the stent, said method comprising the steps of:

8               (a) winding a wire in a zig-zag pattern around  
9       a mandrel having a plurality of upstanding pins defining  
10      said zig-zag pattern to form a first hoop having apices  
11      and a circumference that lies in a plane substantially  
12      perpendicular to the longitudinal axis of said mandrel;

13               (b) longitudinally displacing said wire with  
14      respect to the axis of said mandrel;

15                     (c) winding said wire in a zig-zag pattern  
16        around a plurality of upstanding pins on said mandrel to  
17        form a second hoop, adjacent said first hoop, having  
18        apices juxtaposed to the apices of said first  
19        circumferential hoop and a circumference that lies in a  
20        plane substantially perpendicular to the longitudinal  
21        axis of said mandrel;

22                     (d) longitudinally displacing said wire with  
23        respect to the axis of said mandrel;

24                     (e) repeating steps (a) - (d) to form additional  
25        hoops until a predetermined number of hoops are formed;

26                     (f) annealing said wire on said mandrel;

27                     (g) cooling said wire on said mandrel;

28                     (h) removing said wire from said mandrel; and

29                     (i) securing together at least two juxtaposed  
30        apices of adjacent hoops.

1                     43. An endoluminal stent comprising a  
2        radiopaque marker disposed on at least one end of the  
3        stent.

1                     44. An endoluminal stent as claimed in claim  
2        43 wherein said radiopaque marker comprises a radiopaque  
3        element attached to one end of said stent.

1               45. An endoluminal stent as claimed in claim  
2   44 wherein said element is a platinum wire.

1               46. An endoluminal stent as claimed in claim  
2   44 wherein said element is a gold wire.

1               47. An endoluminal stent as claimed in claim  
2   43 wherein said radiopaque marker comprises a radiopaque  
3   tube disposed around a part of said stent.

1               48. An endoluminal stent as claimed in claim  
2   47 wherein said tube is platinum.

1               49. An endoluminal stent as claimed in claim  
2   47 wherein said tube is gold.

1               50. A bifurcated stent for use in  
2   juxtaposition with an angiographical bifurcation comprising  
3   a proximal stent portion adapted to be disposed within a  
4   blood vessel in juxtaposition with a bifurcation, a first  
5   distal stent portion adapted to extend across the  
6   bifurcation into one of the branched blood vessels, and a  
7   second distal stent portion adapted to allow blood to  
8   flow from the proximal portion into the other branched  
9   vessel and, at least one barb extending radially outward  
10   from any of said proximal stent portion, said first  
11   distal stent portion, and said second distal stent  
12   portion.

1               51. Apparatus for delivering an endoluminal  
2   stent or prosthesis into the vasculature comprising:

3                         (a) an introducer having a on a distal end  
4 thereof; and

5                         (b) a cartridge having an inner tubular member  
6 containing said stent or prosthesis in a compressed  
7 state, an outer sheath, and a second portion of said lock  
8 fitting;

9                         wherein said first portion of said lock fitting  
10 on said introducer mates with said second portion of said  
11 lock fitting on said cartridge to prevent relative  
12 movement of said introducer and said cartridge.

1                         52. Apparatus as claimed in claim 51 wherein  
2 said lock fitting is a Luer lock.

1                         53. Apparatus as claimed in claim 51 further  
2 comprising a hemostasis valve on said introducer and a  
3 pusher adapted to push said compressed stent or  
4 prosthesis through said cartridge, through said  
5 introducer, and into the vasculature.